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ART 34 AMDT

PATENT COOPERATION TREATY

10/524769

NO. 0 PCT/PCTO

16 FEB 2005

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 208320/EP/av	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/NL 03/00566	International filing date (day/month/year) 06.08.2003	Priority date (day/month/year) 16.08.2002
International Patent Classification (IPC) or both national classification and IPC A61B3/107		
Applicant UNIVERSITEIT MAASTRICHT		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

I Basis of the opinion
II Priority
III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
IV Lack of unity of invention
V Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
VI Certain documents cited
VII Certain defects in the international application
VIII Certain observations on the international application

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Date of submission of the demand 24.12.2003	Date of completion of this report 29.10.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office - Gitschiner Str. 103 D-10958 Berlin Tel. +49 30 25901 - 0 Fax: +49 30 25901 - 840	Authorized Officer Jonsson, P.O. Telephone No. +49 30 25901-557



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL 03/00566

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

2, 3, 5-16	as originally filed
4	received on 19.05.2004 with letter of 18.05.2004
1, 1a	received on 18.08.2004 with letter of 16.08.2004

Claims, Numbers

1-31	received on 19.05.2004 with letter of 18.05.2004
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Drawings, Sheets

1/5-5/5	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- the language of publication of the international application (under Rule 48.3(b)).
- the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- the description, pages:
- the claims, Nos.:
- the drawings, sheets:

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5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-31
	No: Claims	
Inventive step (IS)	Yes: Claims	1-31
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-31
	No: Claims	

2. Citations and explanations

see separate sheet

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Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1: US-A-6 024 449;

D2: WO 02 45578 A.

2. Novelty and Inventive Step, Art. 33(1)-(3) PCT:

2.1 Independent claims 1, 20:

Document **D1**, which is considered to represent the most relevant state of the art, discloses (see col. 4/l. 48 - col. 5/l. 34; col.7/l. 55 - col. 8/l. 3; col. 13/l. 66 - col. 14/l. 33 and figures 1,9) a method/arrangement for performing measurements of a topography of a surface, such as the topography of an eye surface (see title), wherein:

- an image is projected onto said surface from at least one projection source using projection means (col. 7/l. 55-61);
- at least a fraction of the light leaving the surface as a result of said projection is received using one or more receiving units (CCD camera 11 in video camera 7, see col. 7/l. 65 and fig. 1; CCD sensor 71 in fig. 9,), and said measurement of said topology relates to surface mapping of said surface (see title);
- wherein said topography of the surface is determined by analysis of said fraction of light leaving the surface (see col. 14/l. 15-17, combination of elevation and temperature topography).

2.2 From this the subject-matter of claims 1,20 differs in that the fraction of light leaving the surface is comprised of light radiated by the surface due to thermal emission, and that said analysis for determining said topography is performed on said light radiated by the surface due to thermal emission.

2.3 The subject-matter of claims 1,20 is therefore new (Article 33(2) PCT).

2.4 The problem to be solved by the present invention may therefore be regarded as how to provide an enhanced method/arrangement of measuring topography of a surface while still leaving the surface undisturbed from the measurement itself.

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2.5 The solution to this problem proposed in claims 1,20 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reason:

In **D1** an embodiment is disclosed which uses a fraction of the light leaving the surface comprised of light radiated by the surface due to thermal emission, see figure 9 in combination with col. 13/l. 65-col. 14/l. 33. In this embodiment however, the measurement is used to detect hot-spots, or regions of overtemperature, on the surface, see **D1**, col. 14/lines 6-11. No mention in **D1** of an improved surface topology can be foreseen, and no steps/features enabling such an analysis can be found in **D1**.

Also **D2** discloses a method and arrangement for topography measurements using analysis of light leaving a surface, but in **D2** autofluorescence in relation to ultra-violet light is used, or an additional layer of fluorescein in relation to infra-red light. **D2** does not disclose the use of thermal radiation for surface topology measurements.

2.6 Claims 2-19 and 21-31 are dependent on claims 1,20 respectively and as such also meet the requirements of the PCT with respect to novelty and inventive step.

3. Industrial Application, Art. 33(1) and 33(4) PCT:

The industrial applicability (Art. 33(4) PCT) is clearly given for the subject-matter of all apparatus claims ("Arrangement for") as claimed in claims 20-31. However, it is noted that no unified criteria exists as regards industrial applicability of diagnostic methods. If the method claims 1-19 are maintained, this issue will therefore be the subject of further examination in a later regional/national phase.

4. In conclusion the Application fulfils the requirements of Art. 33(1) - 33(4) PCT

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Title

METHOD AND ARRANGEMENT FOR PERFORMING MEASUREMENTS OF THE TOPOGRAPHY
OF A SURFACE BY MEANS OF THERMAL EMISSION FROM THE SURFACE

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Field of the Invention

The present invention relates to a method for performing measurements of a topography of a surface, such as the topography of an eye surface, wherein an image is projected onto said surface from at least one projection light source using projection means, wherein at least a fraction of light leaving the surface as a result of said projection is received using one or more receiving units, such as charged coupled device (CCD) based cameras, and wherein the topography of the surface is determined by analysis of said fraction of light leaving the surface.

The invention further relates to an arrangement for performing measurements of the topography of a surface, such as topography of an eye surface, comprising projection means, which projection means comprise at least one projection light source for projecting an image onto the surface, further comprising one or more receiving units for receiving at least a fraction of light leaving the surface as a result of said projection, such as charged coupled device (CCD) based cameras, and means for analysis of said fraction of light leaving the surface to determine the topography of the surface,

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Background of the Invention

Many industrial, scientific and medical processes involve the measurement of the topography of surfaces for variety of applications. In most cases the accuracy of the measurements is of great importance for the quality of the output of the process mentioned. A specific type of surface topography measurements involves the measurements of curved surfaces, as is applied, for example, in

Summary of the invention

It is an object of the present invention to provide a method and arrangement for performing measurements of the topography of a surface, such as an eye or corneal surface, which alleviates the problems 5 described above and wherein the surface remains undisturbed, thus reducing the chance of disturbing measuring results by the measuring method itself.

These and other objects and advantages achieved by the present invention in that there is provided a method for performing 10 measurements of a topography of a surface, such as the topography of an eye surface, wherein an image is projected onto said surface from at least one projection light source using projection means, wherein at least a fraction of light leaving the surface as a result of said projection is received using one or more receiving units, such as charged 15 coupled device (CCD) based cameras, and wherein the topography of the surface is determined by analysis of said fraction of light leaving the surface, characterised in that, said fraction of light leaving the surface is comprised of light radiated by the surface due to thermal emission and wherein said analysis is performed on said light radiated by 20 the surface due to thermal emission.

Projecting the image using, for example, infra-red light provides several benefits. For this colour the eye is not only fully opaque, but the photons that are absorbed by, for instance, a tissue are converted into heat. This heat causes thermal excitation of the matter in 25 the tissue generating radiation comprising wavelengths other than the original wavelength that was projected onto the surface. The light that is not absorbed by the tissue, but may instead be reflected back to the receiving unit (specular reflection, scattering), is still comprised of its original wavelength. This natural process enables filtering of the 30 reflected light from the signal by for example an optical filter or dichroic mirror, leaving only the fraction of light caused by thermal emission to be detected by the detection means. It will be appreciated